REMARKS

This is in response to the Official Action of May 22, 2003. A favorable reconsideration and allowance is respectfully requested.

Claim Amendments

The Examiner has objected to various informalities in claims 1,2, 4 and 25. Claims 1 and 2 have been amended and now refer to a photorefractive polymeric material having "a refractive index" in order to provide a proper antecedent for "the refractive index in those claims." The dependencies of claims 4 and 25 have also been corrected in response to the Examiner's objections.

Independent claims 1 and 2 have also been amended in order to distinguish the invention more clearly from US Patent No. 5,268,862 (Rentzepis'862). More particularly, claims 1 and 2 now relate to methods of writing and erasing/re-writing optical data in "a photorefractive polymeric material having a single isomeric state". The feature of previous claim 3 has also been incorporated into independent claims 1 and 2 so that those claims now specify that the two-photon excitation of the material at the focal point produces "a refractive index inhomogeneity resulting from a non-uniform space-charge distribution within the region of excitation within the photorefractive polymeric material" thereby modulating the refractive index at the focal point to record/re-write data in the photorefractive polymeric material.

Claim 3 has been cancelled and dependent claims 4 to 25 remain unchanged.

As original claims 26 to 45 have been withdrawn from consideration, it is requested that those claims be cancelled and replaced by new claims 46 to 70. New claims 46 to 50 correspond to original claims 21 to 25, but are dependent upon claim 20.

New claims 51 to 54 are method claims dependent upon claim 1 and specify the particular photorefractive polymeric

materials previously claimed in claims 42 to 45.

New claims 55 to 66 are dependent upon independent method claim 2 and correspond to original dependent claims 4 to 15.

New claim 67 is an independent method claim which essentially combines the features of original claim 1 and the constituents of the photorefractive polymeric material of original claim 42. New claim 69 is an independent method claim which combines the features of original claim 1 and the constituents of the photorefractive material of original claim 44.

New dependent claims 68 and 70 add the additional step of re-writing data to independent claims 47 and 49. This step was clearly disclosed in the specification and also as a feature in independent claim 2.

Submissions in Support of the Amended Claims

The Examiner has objected to previous claims 1 and 2 as being anticipated by Rentzepis '862. Rentzepis discloses a method of writing and erasing optical data which uses an active medium having <u>two isomeric molecular states</u>, typically a <u>photochromic</u> material. Rentzepis discloses the use of two intersecting beams of radiation to produce two photon excitation at the point of intersection to change the photochromic material from a first isomeric molecular form to a second isomeric molecular form, e.g. of a different color, thereby forming a bit of data which is read by fluorescence.

In contrast, the method of writing and erasing /re-writing optical data claimed in amended claims 1 and 2 uses a <u>photorefractive</u> polymeric material having <u>a single isomeric state</u>, and light is focused on the photorefractive polymeric material to cause two-photon excitation of the material at the focal point of the beam "to produce a refractive index inhomogeneity resulting from a non-uniform space-charge distribution within the region of excitation within the

photorefractive polymeric material, thereby modulating the refractive index at the focal point to write data".

The Examiner, in his rejection of previous claim 3, stated that Rentzepis '862 teaches such a modulation of the refractive index, referring to column 4, lines 9-14 and 60-64. However, it is respectfully submitted that the Examiner has erred in his interpretation of these parts of Rentzepis '862. Lines 8-13 of column 4 refer to radiation causing an active substance to become an ion and to inducing "spin changes and changes in parity by electromagnetic radiation". However, lines 14-17 then state that once these changes are induced, the prior art relies on the transportive capabilities of the liquid or gaseous support media to permit a chemical reaction to transpire, but the next three lines which the Examiner has apparently omitted to consider state that "the present invention will be seen to reject this approach of inducing chemical reactions in a 3-D medium by irradiating one or more of the reagents with radiation".

Further, the summary of the invention in Rentzepis '862 makes it clear that invention "contemplates selectively inducing isomeric changes in the molecular isomeric form of selected regions within a 3-D active medium by the process of two-photon absorption". Even lines 60-64 of column 4 identified by the Examiner indicate that the active medium of the Rentzepis '862 invention is "responsive to energy level changes stimulated by electromagnetic energy to change from one of its isomeric molecular forms to another of its isomeric molecular forms". It should be understood that this process is quite different from the method of optical data storage of the present invention which uses a photorefractive polymeric material having a single isomeric state in which the two-photon excitation produces a refractive index inhomogeneity resulting from a non-uniform space charge distribution within the region of excitation as claimed in amended claims 1 and 2.

Further, the process of the present invention which uses a photorefractive polymeric material having a single isomeric state does not involve a change in the molecular structure of the polymeric photorefractive material, unlike Rentzepis '862 from which it is apparent that method changing the isomeric molecular form of the active medium is an essential feature of the invention claimed in Rentzepis '862.

In summary, it is submitted that the Applicant is the first to have developed a method of optical data storage using two-photon excitation of photo-refractive polymers which is both erasable and re-writable. The Applicant achieves this by inducing a refractive index inhomogeneity resulting from a non-uniform space-charge distribution in the region of excitation within a photorefractive polymeric material having a single isomeric state.

The use of photorefractive polymers has several advantages of photochromic materials such as disclosed in US 5,268,862 (Rentzepis) in that photorefractive polymers are relatively inexpensive to produce as opposed to photochromic materials, such as spirobezopyran, that undergo a change in isomer states under two-photon excitation. This opens up the possibility of utilizing the method and photo-refractive polymers of the present invention for effective three-dimensional erasable/rewritable optical data storage on a commercial basis.

It is therefore submitted that the invention as claimed in amended claims 1 and 2 is neither taught nor suggested by Rentzepis '862 and that claims 1 and 2 are clearly novel and not anticipated by Rentzepis'862. Further, claims 1 and 2 are not rendered obvious by Rentzepis '862 for the reasons set forth.

Dependent Claims

As claims 4 to 25 and 46 to 70 are all dependent from either claim 1 or claim 2, it is submitted that those claims are allowable with claims 1 and 2.

Notwithstanding the allowability of the dependent claims as outlined above, it is submitted that there are various novel and inventive features in those dependent claims which are neither taught nor suggested by the cited references. For example, none of the cited references teaches illumination of a photorefractive polymeric material with electromagnetic radiation having a wavelength in the ultraviolet (UV) or visible spectrum to produce a redistribution of the spatial distribution of the electric charges forming bits of the data to erase the recorded data" as claimed in dependent claims 4 and 55. While Rentzepis '862 discloses performing an erasure cycle "by increasing the temperature of the sample and/or by eradiation with infrared or visible light", the information is erased by the molecules returning to the original isometric form, and **not** by "a redistribution of the spatial distribution of the electric charges forming the bits of data" as claimed in claims 4 and 55.

With regard to dependent claim 51 and new independent claim 67, it is submitted that these claims are also novel and are not obvious having regard to Rentzepis '862 and US Patent No. 5,744,267 (Meerholz et al). Meerholz et al discloses a photorefractive device which includes a layer of a photorefractive polymer composite comprising similar materials to those claimed in claims 51 and 67. However, the photorefractive polymer composite of Meerholz et al is sandwiched between two transparent electrodes in the device which is used for <u>holographic storage</u>. Holographic devices, by design, require the interference from two non-focused intersecting beams. As a result of the weak interaction with the material, a poling field produced from the two transparent electrodes is required. Neither of these are used or required in the present invention. It is therefore submitted that it would not be obvious to combine the teaching of Meerholz et al with Rentzepis '862 because there is nothing in the disclosure of Meerholz et al to suggest that the

photorefractive polymer disclosed therein would be suitable for use in the method of Rentzepis '862 which is concerned with the use of a material having at least two isomeric molecular forms. Further, a combination of the teachings of Rentzepis '862 and Meerholz et al would fall well short of the invention claimed in claims 51 and 67 because neither reference discloses a method in which light is focused on the photorefractive polymeric material to cause two-photon excitation of the material at the focal point thereby modulating the refractive index of the material at the focal point to record data.

With regard to dependent claim 53 and independent claim 59, it is submitted that these claims are also novel and non-obvious having regard to any combination of the cited references. Whilst Rentzepis '862 discloses the use of a photochromic material contained within a polymer such as polymethylmethacrylate (PMMA), there is no disclosure in Rentzepis '862 or any other of the cited documents of a photorefractive polymeric material which also includes DMMPA. TNF and ECZ in addition to PMMA. Therefore, claim 33 and independent claim 49 are clearly non-obvious and involve an inventive step having regard to the cited references.

Having regard to the amendments and the remarks above, it is respectfully submitted that this application is in order for allowance in all respects, and favorable reconsideration of this application is respectfully requested.

A petition for a three-month extension of time and the required fee are enclosed.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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